



Isotope Programs

Office of Nuclear Energy
U.S. Department of Energy

January 2006

Background

The Department of Energy's Isotope Programs produces and sells stable and radioactive isotopes that are widely used by domestic and international customers for medicine, industry, research, and homeland security applications. DOE provides isotopes only when there is no U.S. private sector capability or when the available supply is insufficient to meet U.S. needs. The Department encourages private sector investment in new isotope production ventures and will sell or lease its existing facilities and inventories for commercial purposes.

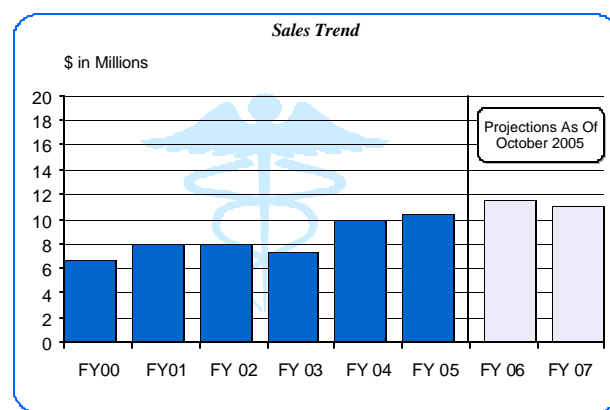
The program operates with a revolving fund. Appropriations to the program are applied to the maintenance and upkeep of isotope production facilities at the Brookhaven, Los Alamos, Oak Ridge and Sandia National Laboratories. All isotopes are priced to recover production costs. In FY 2005, the Isotope Programs made 448 deliveries to 175 customers, generating revenues of about \$10 million.

Isotopes for Life

Isotopes are used in many applications; a substantial national and international infrastructure has been built around the use of isotopes. Among medical applications, strontium-82 and thallium-201 are used for medical imaging to diagnose diseases and injuries. Californium-252 is being tested to treat a variety of cancers, including advanced hypoxic tumors of the cervix. As a neutron source, californium-252 is also being used for boron neutron capture therapy for malignant gliomas. Another application involves in vivo neutron activation of potassium, lithium, aluminum, and nitrogen. These elements, when present in abnormally high quantities, indicate medical conditions that need attention.

Industrial and homeland security applications include the use of helium-3 in neutron detectors.

Other isotopes whose applications are expanding and, therefore, are now in greater demand, are nickel-63, and californium-252. Nickel-63 is used in devices that can detect explosives and drugs. Californium-252 is used to start up reactors, detect the presence of nitrogen-based chemical explosives, and analyze the sulfur content of petroleum in order to limit the production of acid rain.



Program Highlights for Fiscal Year 2006

In addition to support for continuing operations at four production sites, the Isotope Programs' FY 2006 budget includes the following:

- **Nuclear Energy Protocol for Research Isotopes.** Each year, the Department's Nuclear Energy Protocol for Research Isotopes (NEPRI) guides the selection of research isotopes for development, production and distribution. The goal of the annual NEPRI process is to obtain input from the research community to help DOE select which research isotopes we will produce in the next fiscal year. The NEPRI research isotopes that DOE will produce in fiscal year 2006 are posted on our web site and are summarized below.
- **New Facility at Los Alamos National Laboratory.** The newly constructed Los Alamos Isotope Production Facility started production of medical and research isotopes in

February 2005 and will continue to make a major contribution to the medical community through FY 2006.

- Collaborations.** Isotope Programs and the Missouri University Research Reactor Center (MURR) will continue their efforts to provide a stable supply of short-lived, reactor-made radioisotopes to the research community. In FY 2005, two lutetium-177 targets were irradiated at the High Flux Isotope Reactor located at Oak Ridge National Laboratory. The high neutron flux of this reactor yields high specific activity material that is in demand by medical researchers for the treatment of lung, ovarian, and other cancers. The irradiated targets were shipped to MURR for chemical processing, analysis, and distribution for customer evaluation and feedback. Preliminary analysis by the customers indicates that the specific activity of the material is high, as expected, and the presence of impurities is low. This trial irradiation lays the groundwork for future collaborative efforts to produce and distribute this and other reactor isotopes.

In addition, Isotope Programs has collaborated with a private sector owner of a linear accelerator and DOE national laboratories in order to develop a stable supply of copper-67, a short-lived isotope that cannot be inventoried and must be routinely made and that is in high demand for in targeted cancer therapy. To date a number of target irradiations have been performed in a research and development effort to enhance the specific activity of the copper by inhibiting the introduction of unwanted trace elements. Additional steps may involve changing the target material adjusting production parameters.

Isotopes planned for production in FY 2006

NEPRI Research Isotopes

Actinium-225 Silicon-32

Arsenic-73 Technetium-95m

Beryllium-7 Tungsten-188/Rhenium-188

Commercial Isotopes

Cadmium-109 Sodium-22

Californium-252 Strontium-82

Germanium-68 Strontium-85

Iron-55 Yttrium-88

Nickel-63 Zinc-65

Selenium-75

Stable Isotopes and Long-Lived Radioisotopes

Stable isotopes, including helium-3, lithium-6 and -7, will continue to be sold from DOE's existing inventory. The Department continues to sell radioactive isotopes, such as bismuth-207, gadolinium-148, and many others, from its inventory.

Summary

Research into the use of isotopes for medical, industrial, environmental, and other important

applications shows great promise to improve the quality of life for the citizens of the United States and the world. Growth in these very beneficial and cost-effective applications can only occur if the infrastructure for reliable production of isotopes is maintained and isotopes are made available to researchers. Through its Isotope Programs, the Department of Energy is committed to continue its support of this very valuable research.

| Program Budget Isotope Programs (\$ in Millions) | | |
|--|--------------------------------|---------------------------|
| | FY 2006 <u>Adj. Approp.</u> | FY 2007 <u>Request</u> |
| Medical Isotopes | | |
| Infrastructure | \$14.2 | \$15.6 |